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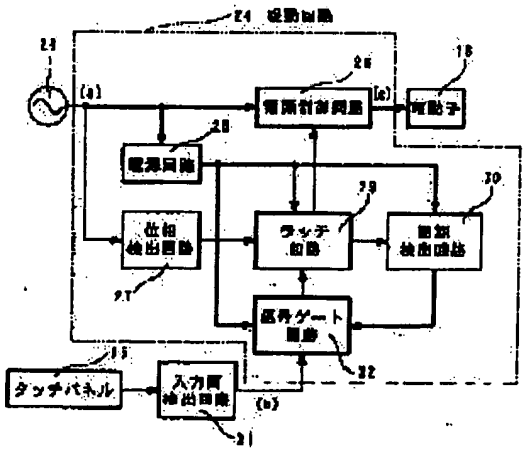
(54) DEPRESSION SENSATION GENERATING DEVICE FOR TOUCH PANEL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a depression sensation generating device for a touch panel which securely generates a depression sensation giving no shock, etc.
SOLUTION: This device is equipped with a needle 18 which is provided facing the touch panel 15, a driving waveform output circuit 25 which drives the needle 18, and a driving circuit 24 which moves the touch panel 15 by outputting a driving waveform for a 0.5 to 1.5 cycle, and the driving circuit 24 comprises a phase detecting circuit 27 for the start of operation, a latch circuit 29 which temporarily holds a detected phase, a cycle detecting circuit 30 for the driving waveform, a signal gate circuit 32 which generates a clear signal for a latch of the latch circuit 29, and a power source control circuit 26 which generates the driving waveform of a 0.5 to 1.5 cycle. The driving waveform output circuit 25 can be simplified by using the commercial AC power source.



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the feeling generator of press of the touch panel which was made to carry out the feel of having pressed to a direct fingertip in the touch panel which presses and carries out alter operation of the electrode sheet metal with a finger.
[0002]
[Description of the Prior Art] Conventionally, since the stroke when pressing electrode sheet metal with a finger in this kind of touch panel is very as small as 0.1-0.5 etc.mm etc., it is unclear whether the switch turns on or not, it will surely press too much strongly and a substrate will bend. Therefore, when a switch turned on, there was a thing of making sound or the color of a press portion changing.
[0003] Some which are sensed by visual sense from which some which make such sound and are sensed by the acoustic sense have a possibility of it being unable to sense in the one hard of hearing, or mistaking for external noise, and a color changes had an oversight, and there was a not employable problem in small equipment. Therefore, when electrode sheet metal is pressed and a switch turns on recently, some which were made to carry out multiple-times vibration have a touch panel.
[0004]
[Problem(s) to be Solved by the Invention] Among these, in some which a touch panel vibrates and sense switch-on, when the vibration when touching electrode sheet metal with a finger continued two or more times, there was a problem that a shock which is receiving an electric shock to the user was given.
[0005] this invention aims at offering the feeling generator of press of the touch panel it was made to make generate certainly, without giving a shock which is receiving an electric shock in 1 time of the feeling of press similar to the feeling of a click at the time of switch-on.
[0006]
[Means for Solving the Problem] In the touch panel with which this invention is detected by the input-screen detector 31, and displayed press of the input screen of a touch panel 15 by the display panel 11 The needle 18 which the aforementioned touch panel 15 was made to face and was prepared, and the drive wave output circuit 25 which outputs the HARASHIN number wave for driving this needle 18, The drive circuit 24 which only 0.5 to 1.5 period outputs the output wave of this drive wave output circuit 25, and carries out movable [of the aforementioned touch panel 15] is provided. this drive circuit 24 The phase detector 27 for detecting the phase of a start of a drive wave of operation, and the latch circuit 29 which holds temporarily the phase detected by this phase detector 27, It is the feeling generator of press of the touch panel characterized by the bird clapper from the periodic detector 30 which detects the period of a drive wave, the signal gate circuit 32 which creates the clear signal of a latch of the aforementioned latch circuit 29, and the power control circuit 26 for making the drive wave of 0.5 to 1.5 period. A shock which is receiving an electric shock is not given by such composition.
[0007] The simplification of a circuit can do the drive wave output circuit 25 by using a commercial alternating current power supply. moreover, the phase detector 27 By detecting the abbreviation 0V point of the alternating current signal of a sine-wave form outputted from the drive wave output circuit

25, and starting a driving signal from this detecting point An injury is not done to a needle 18. further the signal gate circuit 32 After pressing a touch panel 15, when the signal has been sent from the input-screen detector 31 during fixed re-press prohibition time By making the function for canceling this provide, it can prevent that a needle 18 carries out incorrect differential by unstable press operation during re-press prohibition time.

[0008]

[Embodiments of the Invention] One example of the feeling generator of press of the touch panel by this invention is explained based on drawing 1 or drawing 4 . In drawing 3 and drawing 4 , 10 is plate-like housing. ON of the switch of the transparent touch panel 15 of the upper part attaches the plate-like display panel 11 as which a number, a character, a figure, etc. are displayed in the center of the upper surface of this housing 10. It is located in four corners of the periphery of this display panel 11, and the pillar base-like cushion plinth 16 is formed. Although this cushion plinth 16 is a thing made of the rubber for carrying a touch panel 15, if it is too soft not much, since the movement at the time of press of a touch panel 15 will be absorbed, that whose degree of hardness is 50 - 60 degrees is used. Moreover, some bending prevention plinths 17 which suppress the bending when pressing the touch panel 15 other than this cushion plinth 16 are formed in the inferior surface of tongue of a touch panel 15 with few crevices.

[0009] The aforementioned touch panel 15 consists of many insulating salients 13 which consist of an insulating material for making a crevice between the substrate 12 which consists of a transparent glass plate, the electrode sheet metal 14 of two sheets with the transparent upper surface, and these electrode sheet metal 14 of two sheets. The needle 18 which becomes the lower part of the end marginal part of the aforementioned touch panel 15 from the piezoelectricity vibrator using the piezoelectric effect is formed. The end face section of this needle 18 is fixed by the susceptor 20, an interstitial segment is supported with the free support shaft 21, and contact 19 prepared in the upper surface of a point is further attached in contact with the inferior surface of tongue of the substrate 12 of a touch panel 15. The periphery enclosure of the upper surface of the aforementioned touch panel 15 has a crevice 23, and is protected by the periphery flange 22.

[0010] The drive circuit 24 which drives the aforementioned needle 18 is shown in drawing 1 . In this drawing 1 , 25 is the drive wave output circuit which used 50 or the 60Hz source-power-supply wave as it was. This drive wave output circuit 25 is connected to the phase detector 27 for detecting the power circuit 28 for supplying DC power supply to the power control circuit 26 for making a drive wave, and each circuit, and the phase of a start of a drive wave of operation. While the periodic detector to which the latch circuit which holds temporarily the wave which detected 29 by the phase detector 27, and 30 detect the period of a drive wave, and 32 create the clear signal of a latch of a latch circuit 29, the signal gate circuit for canceling the instant OFF by the chattering etc. and 31 are input-screen detectors which detect ON of the switch by the touch of a touch panel 15, and OFF.

[0011] Operation by the above circuitry is explained based on drawing 2 . The commercial alternating current power supply from the drive wave output circuit 25 is a power circuit 28, for example, is changed into DC5V and supplied to a latch circuit 29, the periodic detector 30, and the signal gate circuit 32. Moreover, in the phase detector 27, the phase of a 50 or the power supply wave of 60HZ(s) as shown in drawing 2 (a) from the drive wave output circuit 25 is monitored continuously, and the phase a2 when changing from + to - is detected and outputted.

[0012] Here, the upper surface of a touch panel 15 should be pressed with the finger at t 1:00, and the up-and-down electrode sheet metal 14 of two sheets should short-circuit. Then, it is detected by the input-screen detector 31, and a trigger signal is sent to the signal gate circuit 32. In the signal gate circuit 32, the first phase a2 which sent the signal as shown in drawing 2 (b) to the latch circuit 29 based on this trigger signal, and has been sent from the phase detector 27 is latched.

[0013] With the signal from a latch circuit 29, as shown in drawing 2 (c), the gate opens the power control circuit 26 at a 2:00. A signal is simultaneously sent to the periodic detector 30 from a latch circuit 29, for example, one period is detected. One period is set to 20ms when a source power supply is 50Hz. Moreover, one period is set to about 16.7ms when a source power supply is 60Hz. If the signal of

1 period progress outputs from the periodic detector 30, in the signal gate circuit 32, a clear signal will output, it will send to a latch circuit 29, and the gate of the power control circuit 26 will close by the signal from a latch circuit 29. Consequently, the voltage of the sine-wave type of one period as shown in drawing 2 (c) from the power control circuit 26 outputs, and a needle 18 carries out movable up and down only once.

[0014] Thus, although the voltage of - is first impressed to a needle 18 by the half period and the voltage of + is impressed to a needle 18 by the following half period, a needle 18 is set up so that it may be distorted below on the voltage of - and may be distorted upwards on the voltage of +. Thus, since the cushion plinth 16 will be crushed a little and a touch panel 15 will move below when a touch panel 15 is pressed with a finger if constituted, it follows in footsteps of distortion by the lower part by the voltage of - of the point of a needle 18. And a touch panel 15 is momentarily pushed up by the distortion to the upper part by the voltage of + of the following needle 18. This movement gets across to a finger and what the switch turned on is taken in.

[0015] Next, after pressing a touch panel 15, when the signal has been sent from the input-screen detector 31 during fixed re-press prohibition time at t 2:00 during 100ms, it is made for a needle 18 not to drive by unstable press operation by canceling this in the signal gate circuit 32.

[0016] If voltage like pulse shape which rises rapidly is impressed to a needle 18 or it impresses from the high voltage first also with a sine-wave form, a crack may be entered and damaged to the needle 18 which consists of a ceramic, and it is not desirable. Therefore, operation is made to perform a needle 18 by impressing the voltage of a sine-wave form started from 0V to a needle 18 by the aforementioned example smoothly. However, even if the starting potential impressed first is not necessarily from 0V, be made to let it be a certain low voltage. However, the voltage at the time of an end may be any between 0V - peak value.

[0017] In the aforementioned example, simplification of a circuit is enabled by using a source power supply as it is as a drive wave output circuit 25. However, you may be not the thing restricted to this but a separate oscillator circuit.

[0018] Although it is desirable that they are the half period or 1.5 periods which do not give feeling which received an electric shock, but begin from 0V in order to tell the flight readiness of a touch panel 15 certainly to a finger moreover, and return to 0V although used in the aforementioned example by one period which impresses 0V of the sine-wave type of source-power-supply 100V first, and returns to 0V, it can be set as which range between 0.5-1.5Hz.

[0019]

[Effect of the Invention] this invention can make a feeling of press generate certainly, without giving a shock which a touch panel 15 vibrates more than required, and is receiving an electric shock, since the drive wave output circuit 25 which outputs the HARASHIN number for driving a needle 18, and the drive circuit 24 which only 0.5 to 1.5 period outputs the output wave of this drive wave output circuit 25, and carries out movable [of the touch panel 15] were provided.

[0020] By using a commercial alternating current power supply, the drive wave output circuit 25 can simplify circuitry, and can offer cheap equipment.

[0021] The needle 18 which the touch panel 15 was made to face and was prepared, and the drive wave output circuit 25 which outputs the HARASHIN number wave for driving this needle 18, The drive circuit 24 which only 0.5 to 1.5 period outputs the output wave of this drive wave output circuit 25, and carries out movable [of the aforementioned touch panel 15] is provided. this drive circuit 24 The phase detector 27 for detecting the phase of a start of a drive wave of operation, and the latch circuit 29 which holds temporarily the phase detected by this phase detector 27, Since it consists of the periodic detector 30 which detects the period of a drive wave, a signal gate circuit 32 which creates the clear signal of a latch of a latch circuit 29, and a power control circuit 26 for making the drive wave of 0.5 to 1.5 period While being able to set up the phase corresponding to the starting potential of the optimal driving signal for the drive of a needle 18, the output period of a driving signal can be set as the most desirable length. The feeling generator of press of the touch panel characterized by things.

[0022] Since the phase detector 27 detects the abbreviation 0V point of the alternating current signal of a

sine-wave form outputted from the drive wave output circuit 25 and the driving signal was started from this detecting point, breakage of a needle 18 is prevented and operation can be smoothly performed in a needle 18.

[0023] The signal gate circuit 32 carries out operation which a needle 18 did not drive and was stabilized by unstable press operation during re-press prohibition time, such as a chattering, by providing the function for canceling this, when the signal has been sent from the input-screen detector 31 during fixed re-press prohibition time, after pressing a touch panel 15.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing one example of the drive circuit 24 for the feeling generator of press of the touch panel by this invention.
[Drawing 2] It is the output wave form chart of each part in drawing 1 .
[Drawing 3] It is drawing of longitudinal section showing one example of the feeling generator of press of the touch panel by this invention.
[Drawing 4] It is the plan which cut and lacked the part in drawing 3 .
[Description of Notations]
10 [-- A substrate, 13 / -- Insulating salient,] -- Housing, 11 -- A display panel, 12 14 [-- A cushion plinth, 17 / -- Bending prevention plinth,] -- Electrode sheet metal, 15 -- A touch panel, 16 18 [-- A susceptor, 21 / -- A free support shaft, 22 / -- Periphery flange,] -- A needle, 19 -- Contact, 20 23 [-- A drive wave output circuit 26 / -- A power control circuit, 27 / -- A phase detector, 28 / -- A power circuit, 29 / -- A latch circuit, 30 / -- A periodic detector, 31 / -- An input-screen detector, 32 / -- Signal gate circuit.] -- A crevice, 24 -- A drive circuit, 25

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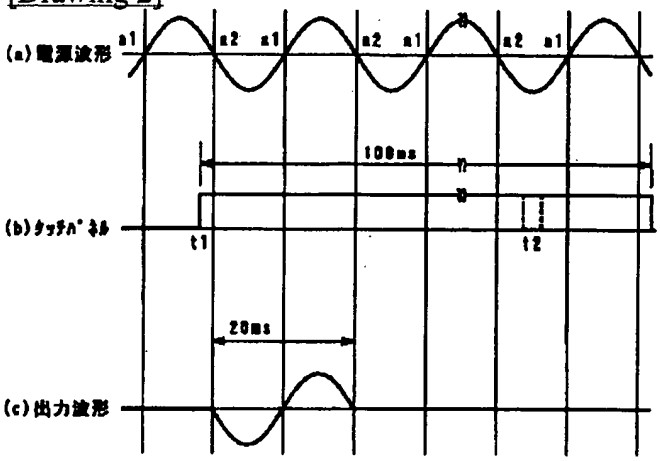
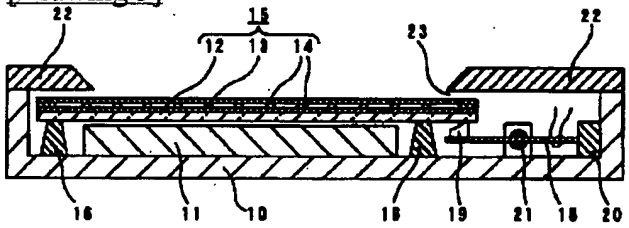
DRAWINGS

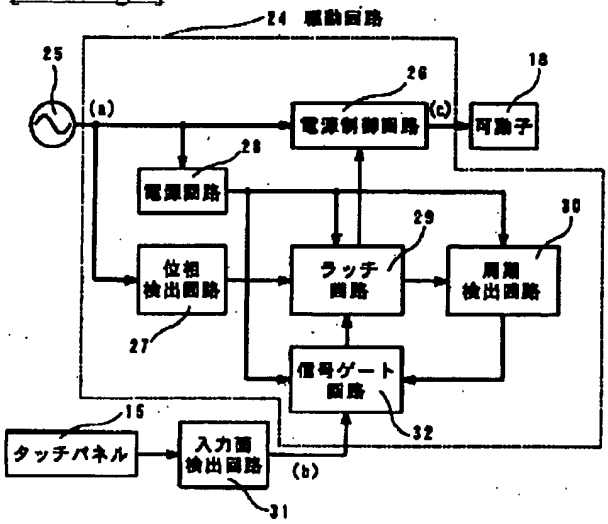
[Drawing 2]



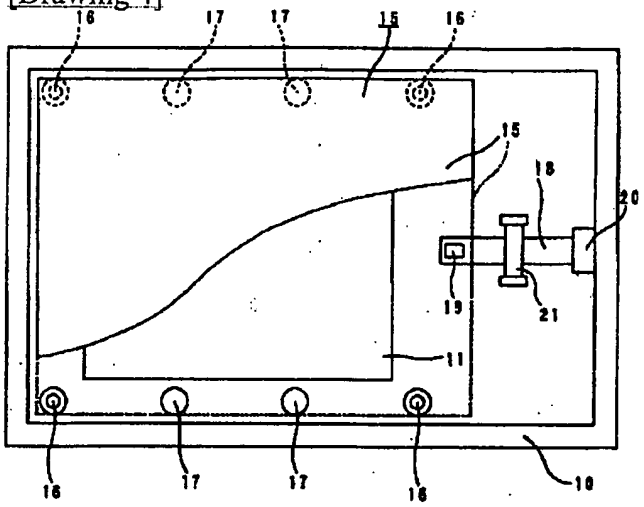
[Drawing 3]



[Drawing 1]



[Drawing 4]



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